STUDY OF THE MARINE ENVIRONMENT OF THE NORTHERN GULF OF CALIFORNIA

University of Arizona
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GSFC ID Number: UN-603

ERTS-A Proposal Number: SR-102

Type I Progress Report for period ending November 30,1972

Bi-Monthly Progress Report for Period August 1 - November 30, 1972

Project UN 603, Study of the Marine Environment of the Northern Gulf of California

Part 1. Contract Objectives

The primary objective of this investigation is to develop baseline information for use in interpretation of orbital remote imagery to determine the feasibility of monitoring the northern Gulf of California environment. In order to achieve this objective, major emphasis is placed on documentation of quantitative seasonal variation within the study area in such physical oceanographic parameters as salinity, temperature, water clarity, bottom configuration, current patterns, and possibly, primary productivity. Thus, a significant proportion of the effort relates to the establishment and coordination of extensive ground observation in the form of monthly oceanographic sampling throughout the study area. In support of the primary objective, and of the ERTS program, technology will be developed to utilize the Data Collection System (DCS) supplied by NASA, for in situ measurement of oceanographic parameters on a continuous basis.

Secondary objectives include the training and coordination with Mexican scientists and students in the methods of physical oceanographic observation, photo interpretation techniques and methods of analysis of ERTS-1 imagery; application of results to important Mexican fisheries problems; and accumulation and update of information on the Colorado River estuary and delta area which might be of use to other investigators in both the United States and Mexico.

Part 2. Summary of Work Performed During the Report Period

With regard to oceanographic applications of the DCS, significant progress has been made in the reporting period. An exhaustive review of sensor design and sensor manufacturers has been completed and the required sensors have been purchased in consultation with the selected manufacturers. In certain cases, design modifications within the component electronics were made at the factory to facilitate interface with the anticipated signal conditioning configuration. In other cases, the required modifications will be made at the University of Arizona laboratory.

Work has begun on the signal conditioning and timing sequencers for the first DCS unit. The first operational testing will begin in one week and will consist of mounting a skeleton system on the roof of the laboratory for transmission of data through ERTS-1 linkage. Important tests will be made on the timing sequencers and the signal conditioning electronics.

A review of the entire oceanographic DCS to be utilized, including a listing of the selected sensors, design modifications, mode of signal conditioning, fail-safe precautions to be taken, etc., will be included in the Progress II report, to be submitted next month.

The design of the buoy platform to house the oceanographic DCS has been finalized and the first of the two platforms has been constructed and successfully tested for seaworthiness. The buoy is constructed of steel-reinforced concrete over a core of polyurethane foam. The design is unique in that it is dynamically engineered to remain buoyant in shallow areas characterized by extremely strong currents (often in excess of ten knots). It is expected that the buoy design will be applicable to future studies which require means of constant monitoring of estuarine-river delta environments--often important nursery areas supporting commercial fisheries. Design specifications and photographs of the model and constructed platform will be included in the Progress II report.

All design specifications of both the DCS electronics and the platform have been transmitted to Oceanografia y Senalamiento Maritimo in Mexico City. We have received repeated assurance from this agency that full permission is granted for use of the platforms in Mexican territorial waters. In January the first official internal Mexican notice concerning the oceanographic buoys will be published in their "Advice to Mariners" (title translated). This will constitute official permission to deploy as soon as the system is ready.

As stated above, a significant portion of the investigative effort must be expended toward establishing and coordinating a regular ground observation schedule. This consists of monthly oceanographic cruises in the study area for measurements of physical oceanographic parameters. The contract was scheduled to contain a 4-month Phase I period designated as "Data Analysis Preparation." Within that four months we have been able to obtain charter of the Universidad de Sonora ship "Adventyr" and to complete the necessary modifications and repairs to render her seaworthy and capable of research operations. After three shake-down cruises utilizing a variety of instruments, methods of measurement and cruise plans, we have arrived at a workable schedule and have obtained the required oceanographic instrumentation. Appendix I contains examples of forms used for recording and summarizing ground observations, a list of instruments used aboard ship, a map of the oceanographic stations to be visited each month, and the required form for gaining permission to leave the home port of Puerto Peñasco, Sonora, Mexico.

Previously, the scheduling of the monthly cruises was to be governed by the dates of aircraft overflights. Official permission for overflights of the test area has been denied and cruises are now scheduled according to a 36-day period in order to obtain ground observations for correlation with satellite imagery.

After reviewing ERTS-1 imagery of the study area, we feel that lack of overflight remote data will not significantly impair our ability to

accomplish the primary objective of the contract. Certain secondary objectives originally stated in the proposal will prove impossible, e.g., an attempt to determine fishing intensity by means of grid overlays of low altitude imagery. However, preliminary analysis of the first two months of ERTS-1 imagery reveals that much of what we had hoped to learn from the high altitude overflights is contained in the orbital imagery. Should overflight permission be granted in the future, we are prepared to pursue analysis, but it will have a lower priority than indicated in the original contract proposal.

The success of our project depends to a large extent upon the degree of cooperation with Mexican colleagues and institutions. Much progress has been made toward establishing a coordinated program of ground observations with the Universidad Autonoma de Baja California and Universidad Nacional Autonoma de Mexico. On December 2nd, a joint meeting was held in Yuma, Arizona to discuss this aspect of our investigation and a summary of the proceedings of that meeting are included in this report as Appendix II.

Of special importance is the possibility that a ground observation cruise, coordinated on a 36-day schedule, may be undertaken by the Universidad Autonoma de Baja California. This schedule would alternate with that of the University of Arizona with respect to the satellite and thus yield full 18-day ground observation coverage for correlation purposes.

A data storage, library and retrieval system has been established to facilitate analysis of ground observations. The data library is, in the first phase, organized to receive data from all cooperating institutions in raw form, to store the data on computer cards which follow the NODC format and processing recommendations, and to disseminate data in standardized format to all cooperating scientists on an exchange basis. The second phase of the ground data processing plan will include the generation of contour maps for temperature, salinity and turbidity, on a monthly basis. Toward the conclusion of the project, analysis will proceed on the time dependence of spatial distribution and range for each of these parameters. The third phase of the system deals with storage and analysis of oceanographic DCS data and is not yet active.

The programs for processing of raw data into standardized form have been written and are operating on a routine basis. Data from the first three cruises has been processed and disseminated. The program for plotting of contour maps is presently being written and generation of these maps for the first three cruises should be completed during the next two weeks.

Analysis of the ERTS-1 imagery is proceeding on schedule. Correlations with ground truth using the contour maps should begin in January.

Part 3. Work Schedule

November 1 officially began Phase II, "Preliminary Data Analysis."

Work has progress according to schedule and our final data analysis plan will be ready for submission in early January.

Part 4. Funding

The primary objective of this investigation is the quantification of seasonality and correlation of ground observations with satellite imagery of the northern Gulf of California environment over a one year period. Since satellite imagery was not available until August 5th, and ground observations were not possible until the first cruise on August 30th, the possibility under the present contract, expiring June 30th, 1973, exists for the study of only 10 months of data. In addition, because of the extensive time required to establish operationality of the ground observation plan, the early data is not of optimal quality.

In consideration of these factors, a request will be submitted for funding to support ground observation operations through August, 1973, or the remaining life of the ERTS-1 satellite. The optimum plan, depending upon the life of the satellite, would be to continue the investigative effort until the launching of ERTS-2, scheduled as November, 1973. Plans are now underway for submission of an ERTS-2 proposal. Should an extension of our ERTS-1 efforts be granted and funding of an ERTS-2 proposal be approved, ground observations and analysis would continue over a contiguous 22-month period, a highly desirable situation in consideration of the scientific objectives.

The request for funding an extension of ERTS-1 activities will be submitted within the coming month, after filing our Progress II report; this should establish a means for evaluation of the scientific progress to date of this investigation in respect to the request for additional funding.

The budget agreed upon in our contract will be adequate to complete the investigation to June 30th, 1973, with one exception: Our contract was negotiated to include spare modules for our three DCP's. These were specified as one each of the following: transmitter card, programmer card, analog card and digital-parallel card. We did not receive these spare modules and have been notified by NASA that they are not available. Should problems develop with our DCP's, we have no means of making the necessary repairs.

At this time we wish to make formal request of additional funding in the amount of $1675.00. The amount is based on the estimates for purchase of engineering tools which will be required in the event of DCP failure. A pace PRC-15A rework unit is needed to do the desoldering, removing of conformal coating, soldering and application of conformal coating ($785.00 estimate). Also HP IC trouble shooting probes are needed which are estimated at $590.00. The additional $300.00 will provide for purchase of replacement components, wiring, etc.

During the ERTS user meeting at MTF it was proposed that a central facility be established for the repair of DCP units. We have received no further information regarding this or any other repair facility. Should NASA establish a central location for repair of user DCP's our request will be rescinded; however, because of the importance of our oceanographic buoys for constant monitoring, we are submitting the request at this time in order to insure that this matter will be given prompt attention.

Part 5. Operating Personnel

No significant changes have occurred in the personnel associated with the project.

Part 6. Work Plan for the Next Reporting Period

The work plans for the next reporting period associated with each major phase of the project are presented below.

Oceanographic Data Collection Systems - Lab and field testing of the first data collection system and installation into the first buoy. Development and collection of data. Construction of the second buoy on site at El Golfo de Santa Clara.

Ground Observations - Continuation of monthly cruises and coordination with Mexican scientists to integrate 18-day-observation coverage. Generation of contour mapping of physical oceanographic data. Design of programs for conditioning and analysis of DCS oceanographic data.

Imagery Analysis - First attempt correlation with ground truth. Final preparation of Data Analysis Plan. Continued analysis with multispectral viewer and densitometer. First attempt at digital analysis through cooperative efforts with Purdue University LARS.

Coordination - Second joint meeting of all cooperating scientists, planned for mid-January at the University of Arizona for purposes of planning final stages of integrated ground observation phase and demonstration of imagery analysis techniques.

Part 7. Significant Results

Preliminary analysis of the first three months of ERTS-1 imagery have revealed that the MSS images have particular utility for study of turbidity patterns, current phenomena, and bathymetry throughout the test area. Though final conclusions will depend upon correlation with the ground observations, early indications are that well defined spatial distributions of turbidity exist in the northern Gulf of California, and that for any one point in time, these distributions vary with depth. From a single set of images, as many as 3 turbidity maps may be generated, each indicating a vertical spatial relationship of the turbidity masses.

The spatial distribution of turbidity masses depend partially upon the coincident currents. Separating out the two components of current state in the test area may prove to be difficult since the general circulation current of the northern Gulf of California is masked by the much stronger tidal currents.

Significant differences in the distribution of the turbidity patterns with respect to time have appeared. It is hoped that the ground truth will reveal the reasons for such drastic changes; thus far there does not appear to be correlation with the distinct monthly tidal periodicity as first suspected. In one portion of the test area a stable turbid water mass has appeared constant in the first three months of imagery. This area does correspond with one of high biological productivity.

In the band of deepest penetration, a map can be gathered which roughly corresponds to the bathymetry of the area. In some cases a marked difference exists between published soundings and shelf discontinuities indicated by the imagery. Fathometer records from the ground observation cruises will be used in conjunction with this band to product updated versions of current bathymetric charts.

The extreme tides in the northern Gulf of California result in vast areas which can be classified as intertidal mud flats. The 18-day images often reveal differences in the amount of tidal exposure and also indicate basin evaporation areas. The areas of exposure associated with each tidal state can be defined by means of the ARTES densitometer and computed. Information on the amount of exposure at the varying tidal states is important in analysis of these mud flat areas as nursery grounds for Mexican commercial fisheries.

APPENDIX I

Figure 1

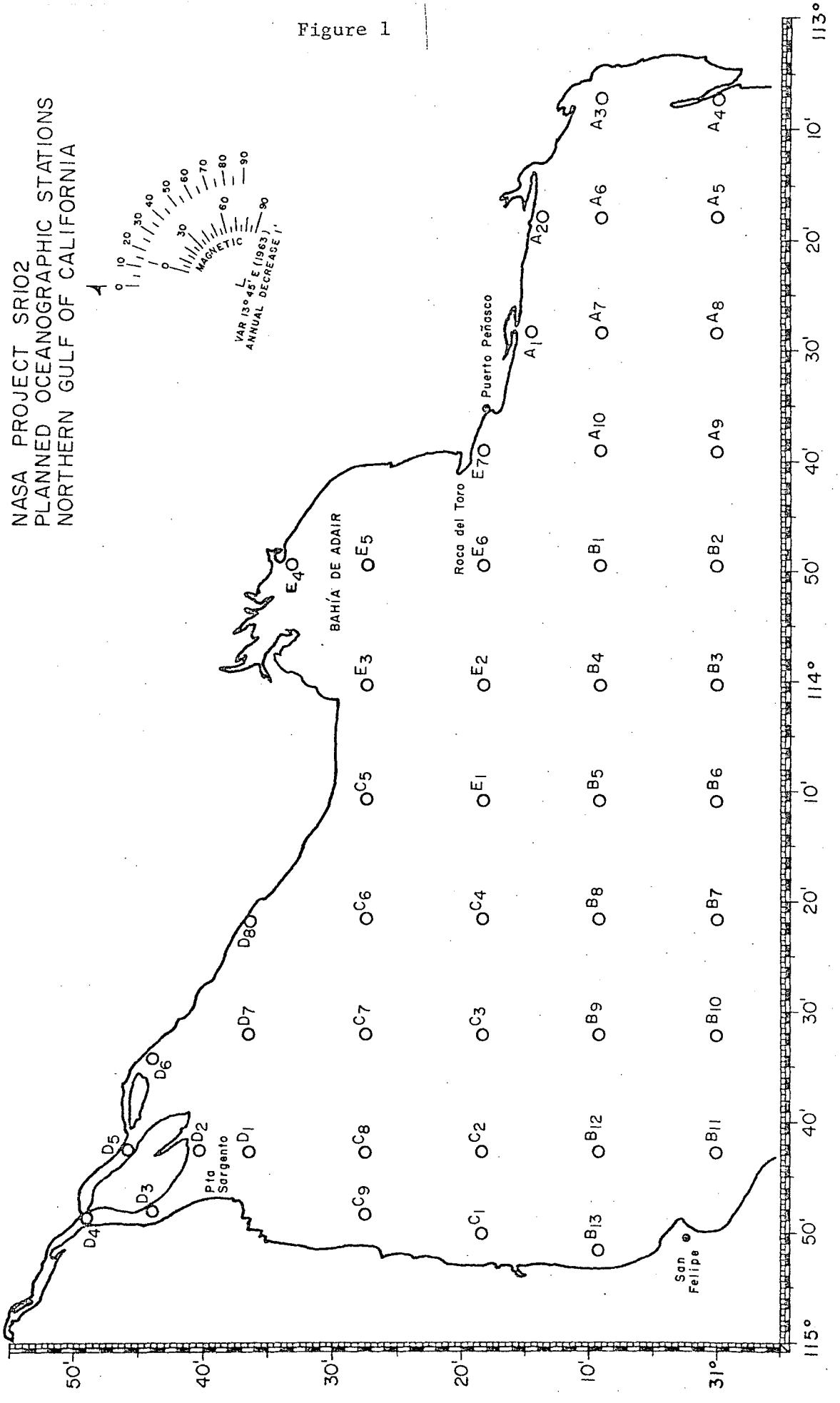
NASA PROJECT SR102
PLANNED OCEANOGRAPHIC STATIONS
NORTHERN GULF OF CALIFORNIA
MAGNETIC
VAR 13° 45' E (1963)
ANNUAL DECREASE 1'
BAHÍA DE ADAIR
Roca del Toro
Puerto Peñasco
Pta Sargento
San Felipe
A1 A2 A3 A4 A5 A6 A7 A8 A9 A10
B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13
C1 C2 C3 C4 C5 C6 C7 C8 C9
D1 D2 D3 D4 D5 D6 D7 D8
E1 E2 E3 E4 E5 E6 E7
31° 10' 20' 30' 40' 50'
113° 10' 20' 30' 40' 50'
114° 10' 20' 30' 40' 50'
115°

Table 1

Oceanographic Stations, NASA Project, Northern Gulf of California

STATION NO.	LATITUDE (to nearest 0.5')	LONGITUDE (to nearest 0.5')
A1	31° 14.0'	113° 28.0'
A2	31° 13.5'	113° 17.5'
A3	31° 09.5'	113° 07.0'
A4	31° 00.0'	113° 07.0'
A5	31° 00.0'	113° 17.5'
A6	31° 09.5'	113° 17.5'
A7	31° 09.5'	113° 28.0'
A8	31° 00.0'	113° 28.0'
A9	31° 00.0'	113° 38.5'
A10	31° 09.5'	113° 38.5'
B1	31° 09.5'	113° 49.0'
B2	31° 00.0'	113° 49.0'
B3	31° 00.0'	114° 00.0'
B4	31° 09.5'	114° 00.0'
B5	31° 09.5'	114° 10.5'
B6	31° 00.0'	114° 10.5'
B7	31° 00.0'	114° 21.5'
B8	31° 09.5'	114° 21.5'
B9	31° 09.5'	114° 31.5'
B10	31° 00.0'	114° 31.5'
B11	31° 00.0'	114° 42.5'
B12	31° 09.5'	114° 42.5'
B13	31° 09.5'	114° 51.5'
C1	31° 18.5'	114° 50.0'
C2	31° 18.5'	114° 42.5'
C3	31° 18.5'	114° 31.5'
C4	31° 18.5'	114° 21.5'
C5	31° 27.5'	114° 10.5'
C6	31° 27.5'	114° 21.5'
C7	31° 27.5'	114° 31.5'
C8	31° 27.5'	114° 42.5'
C9	31° 27.5'	114° 48.0'
D1	31° 36.5'	114° 42.5'
D2	31° 40.0'	114° 42.5'
D3	31° 44.0'	114° 48.0'
D4	31° 49.0'	114° 48.5'
D5	31° 46.0'	114° 42.5'
D6	31° 44.0'	114° 34.0'
D7	31° 36.5'	114° 31.5'
D8	31° 36.5'	114° 21.5'
E1	31° 18.5'	114° 10.5'
E2	31° 18.5'	114° 00.0'
E3	31° 27.5'	114° 00.0'
E4	31° 33.0'	113° 49.0'
E5	31° 27.5'	113° 49.0'
E6	31° 18.5'	113° 49.0'
E7	31° 18.5'	113° 38.5'

Table 2

Parameters to be measured at oceanographic stations with associated instrumentation

PARAMETER	INSTRUMENT OR METHOD
Salinity Temperature Conductivity	Interocean T,C,S probe Model 513 A Measurements at variable depths
Turbidity	Secchi Disk Submarine Photometer (Weston photronic cell type)
Current (speed and direction)	Marsh-McBirney Model 711 Electromagnetic current probe
Phytoplankton Zooplankton	Surface Water Sample 1/2 meter plankton net #6 mesh # 10 bucket
Pressure Wind Speed, Direction	Barometer Model M1110 Dwyer Wind Meter 12" wind sock
Air Temperature Humidity	Weather Measure Corp. Model HM 10 Sling Psychrometer

Project No.	Station No.	lat.	sonar depth	wind	temp.	clouds	sea	swell	con. no.	weather
Vessel		long.		speed	dry	type	ht.	ht.		
Date	Time	navig.	Barometer	dir.	wet	amt.	dir.	dir.	visibility	

SALINITY-TEMPERATURE-CONDUCTIV. Instrument		Parameters	D1	D2	D3	D4	D5	D6
time in	wire angle	conductiv.						
time up	wire angle	temperat.						
		salinity						

CURRENT Instrument						
Depth	X vector	Y vector	heading	speed	angle	direct
D1						
D2						
D3						

PLANKTON SAMPLING	sample 1	sample 2	sample3	sample 4	sample 5
wire length					
wire angle					
type					

TURBIDITY Instrument			
wire length	Deck cell	X factor	sea cell
D1			
D2			
D3			
D4			
D5			
D6			

Secchi Disk reading

OMEGA Computations	
LOP1 B-D reading	
St.1 PPC	
St.2 PPC (-)	
Tot. Correct.	
Corrected reading	
LOP2 C-D reading	
St.1 PPC	
St.2 PPC (-)	
Tot. Correct.	
Corrected reading	
Longitude	Latitude

OTHER SAMPLES (Specify)

COMMENTS

BOTTLE CASTS

no.	time	depth	angle	temp.	samp #	DO	PL	specify	specify	specify	specify	Time abandon station
												Heading to next station

Figure 2

FILED BY _____ PROJECT SUMMARY SHEET DATE _____

PROJECT NO.	PROJECT TITLE	
VESSEL	INCLUSIVE DATES	DESCRIPTION OF PURPOSE & AREA SAMPLED
NO. OF STATIONS PLANNED	NO. OF STATIONS TAKEN	
LIST OF STATIONS OMITTED		
STATION MAP ATTACHED	STATION LIST ATTACHED	
CHIEF SCIENTIST	CAPTAIN	
OTHER SCIENTIFIC PERSONNEL	GENERAL REMARKS	

12

Figure 3

PARAMETER	EQUIPMENT OR INSTRUMENTS	REMARKS

TYPE OF SAMPLE OR RECORD	STORAGE LOCATION	DISSEMINATED TO	COPY	ORIGINAL	DATE

TYPES OF ANALYSES, COMPUTATIONS, CALIBRATIONS	ANALYST	FILE LOCATION	DISSEMINATED TO	DATE

Figure 4

BIOLOGICAL SAMPLES

TYPE	ORIGINAL PRESERVATIVE	OTHER PROCESSING

Figure 5

UNIVERSIDAD DE SONORA

UNIDAD EXPERIMENTAL PEÑASCO

PUERTO PEÑASCO, SONORA

AVISO DE SALIDA

C. CAPITAN DEL PUERTO,

Presente:

Por el presente nos permitimos informar a usted que el Yate a nuestra consignación denominado ..... del porte de ..... toneladas brutas y ..... netas zarpará el día ..... con destino a ALTA MAR. Vía Estudios Cientificos .....

Su calado a proa y popa es de ..... y ..... Mts., respectivamente.

La tripulación que atiende los servicios del barco será compuesta por el personal que consta en el reverso de este aviso.

Los documentos que anexamos, correspondientes a la salida del barco, son los siguientes:

(7) ejemplares de este Aviso de Salida.

Asimismo hacemos constar que el barco a cumplido con todos los requisitos reglamentarios, por lo que ruego a usted tome nota de la salida de dicha embarcación.

Puerto Peñasco, Son., a ..... de ..... de 197.....

Como Capitán del citado buque declaro que los datos contenidos en el presente Aviso, son exactos, así como de acuerdo con lo dispuesto en el Artículo 29 del Reglamento para la Navegación de Cabotaje, no hay impedimento legal, para que zarpe la embarcación la cual se halla en buenas condiciones de navegavilidad.

El Capitán del Barco

.....

En atención a que fué nesesario que el buque zarpara en tiempo inhábil para la Capitanía del Puerto, carece este aviso del sello de la Oficina y en cumplimiento de lo dispuesto en el Artículo 24 del Reglamento para la Navegación de Cabotaje, los suscritos, bajo su responsabilidad, autorizan el zarpe de dicha embarcación, en virtud de no haber contravenido ninguna disposición de la materia y en el concepto de que han cumplido con lo dispuesto en el Artículo 26 del citado Reglamento y de que han entregado a la Autoridad Marítima en las tres primeras horas hábiles, los documentos correspondientes al zarpe de esta embarcación.

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APPENDIX II

PROCEEDINGS OF NASA PARTICIPANTS MEETING, YUMA, ARIZONA, 2 DECEMBER, 1972

Attending:
Dr. Saul Alvarez Borrego, U de Baja Calif. (Phys. & Chem. Oceanography)
Maestro Virgilio Arenas, UNAM (Productivity; Pesticides in plankton; Post-larval shrimp abundance)
Sr. David Cabrera, U of Ariz. (Captain of R/V "ADVENTYR")
Lt. Gustavo Calderon, Oceanography Section, Mexican Navy & U of A Grad Division (Photo-Interpretation)
Ms. Claudia Farfau, U de Baja Calif. (Plankton studies)
Sr. Luis Galindo, U de Baja Calif. (Phys. & Chem. Oceanography)
Dr. Richard Glenn, U de Baja Calif. (Marine ecology)
Sr. Sergio Guevara, U de Baja Calif. (Ichthyology)
Ms. Christine Flanagan, U of A (NASA program coordination; Ground truth data collection; Computer programming)
Dr. John Hendrickson, U of A(NASA Principal investigator)
Mr. Steven Howard, U of A (Buoy engineering)
Ing. Jose Ramon Infante Leon, U de Sonora (Ship management; General coordination
Dr. Larry Lepley, U of A. (Remote sensing; Imagery Analysis)
Mr. Robert Mangum, U of A (Electronics, ship and buoys)
Mr. Richard McCrory, U of A (Ground truth data collection; General support functions)
Ms. Janna McIntosh, U of A (Computer programming; Data handling)
Ocean. Katsuo Nishikawa, U de Baja Calif. (Coordination for U de Baja Calif.)
Ms. Amelia Nishikawa, U de Baja Calif. (Heavy metals in sediments & organisms)
Mr. G. Richard Stonesifer, NASA Washington (Technical monitor for program)
Ms. Patricia Stout, U of A (Secretary, General support functions)

Meeting 1 -- GROUND TRUTH OPERATIONS (1515 - 1830 hours)

A. Completion of Operational Handbook for the Project.

Copies of the latest draft of the handbook for data acquisition, storage, retrieval, and analysis were distributed and the purpose and structure of the handbook were explained briefly. It is hoped that this handbook will serve all participants as a standard reference, to produce uniformity of data and optimal coordination of efforts between the different participating institutions.

Following general explanation and discussion of the handbook, there was discussion of the Appendices which will describe the particular activities which each participating institution hopes to carry out. It was agreed that, in their initial form, each of the Appendices should represent the ideals which each institution had in mind, and that the following priority system and developmental process would take place:

1. First, the terms of the NASA contract must be fulfilled. All tasks listed in the contract will have priority over other activities which, if undertaken in addition to contract items,must have not-to-interfere status.

2. Second, each institution will prepare and circulate to the others its own Appendix to the handbook, listing the activities which it would ideally like to carry out, describing methods, instrumentation, data forms, etc. Appendix I, presently showing U of A NASA contract activities only, was presented as one form of the model which could be referred to in composing other appendices. Each of the above primary drafts of Appendices, including one from the U of A showing non-contract

activities in addition to contract tasks, should be circulated to the other participating institutions within the very near future.

3. Third, upon receipt of the other parties' suggestions (primary drafts of Appendices), there would be correspondence between institutions to reduce areas of duplication, accomplish plans for work-sharing, and accomodate for conflict with the first-priority contract tasks. The U of A is willing to serve as central clearing house for such work, but will leave resolution of two-party problems to the particular institutions immediately concerned (for example, possible duplication of pesticide studies by U de B.C. and UNAM).

4. After identification of overlaps and conflicts, any necessary compromises between the ideals of participants will have to be arranged; following this, the final forms of the Appendices describing each institution's planned activities will be written out and included in the handbook for long-term reference.

Appendix I, describing U of A contract activities, was presented in final form. To this will be added any additional, non-contract activities which the U of A will ideally like to undertake.

Appendix II, describing U de B.C. hydrographic studies desired, was presented in semi-final form (some of the data formats are in the process of being revised). In addition to this material which was passed out to each participating institution at the meeting, the following were noted as items on the U de B.C.'s list of activities which they would ideally like to carry out and for which descriptive Appendix material would soon be forthcoming:

1. Studies of nutrient distribution and assay of nutrients in the northern Gulf.
2. Heavy metals and chloro-hydrocarbon pesticides in sediments and animals.
3. Transect studies of intertidal biotas (some requiring ship time for access or extension of transects seaward).
4. Correlation of oceanographic data with fisheries product and effort (work on statistics, plus work on catch composition which might involve ship time).
5. Qualitative and quantitative plankton analysis and chlorophyll determinations.
6. Production of a bathymetric map of the northern Gulf.
7. Long-term studies of current patterns.
8. Special, intensive study of current patterns during period 11-29 March, in coordination with multi-ship survey of the entire Gulf of California.
9. Environmental analysis of presumed freshwater areas of the northern Gulf.

Appendix III, describing UNAM activities which they would ideally like to carry out was circulated. This draft version, made up by Maestro Virgilio Arenas on short notice at the meeting, describes activities, methods, and instrumentation; it needs only samples of data forms to be complete, although it is recognized that UNAM may wish to later amend this material which was composed under pressure of time.

No material was presented for Appendix IV, for the Universidad de Sonora. It was recognized that something might be presented by a deadline of December 10th, failing which UNISON would be recorded as participating through use of their ship "Adventyr" and their Puerto Penasco marine lab facilities, and that they would automatically receive copies of the computer data output for any analyses which they might like to carry out.

<u>An important point established by unanimous agreement at the meeting was that all data acquired in the above studies will be freely and automatically transmitted to all institutions listed as data recipients in this study, subject only to certain formalities in the case of U de B.C. referring back to their separate granting agencies.</u>

B. Cooperative Use of the R/V "ADVENTYR" and Instrument Buoys

The following working rules were agreed upon:

1. There will be a limit of 4 scientists per cruise, one designated "Chief Scientist".

2. Detailed description of individual plans for each cruise (names of persons, activities, instruments, etc.) will be mailed to Hendrickson at U of A, to arrive 14 days before embarcation date, with automatic copies to the other participating institutions (Nishikawa for U de B.C.; Arenas for UNAM; Infante for Unison). Receipt of cruise plan at U of A to be confirmed within two days of arrival by telegram or telephone call. Any required modifications of plans to be determined, and all parties notified (telegram or telephone call) by 7 days before embarcation date.

3. Within 14 days of cruise ending date, a report on each cruise will be prepared by the designated Chief Scientist for that cruise and sent out to each participating institution.

4. All of the originals of instrument charts are to be kept by U of A personnel and deposited permanently in the archives at the U of A. As necessary for the work of other institutions,these will be copied by either xerox or blue-printing process. If such copies prove inadequate and originals must be used by other institutions, they will be transferred out of the archives under high-security, loan conditions (hand-carrying or reply-certificate, registered mail within the U.S. mail system only).

5. Approximately every 30 days, newly acquired data will be run through the UA computer and copies mailed out to listed data recipients. On the same schedule, later generations of earlier data (with minor corrections or changes) will be transmitted.

6. The following regulations for shipboard living and work, suggested by the Captain at the request of the general meeting, were adopted in full:

   A. All meals eaten must be taken on time, and there will be set hours after which no food will be available (the galley must function as instrument room, etc.).

   B. Personal cleanliness, neatness in handling and disposal of personal gear, and consideration for the needs of others must reach a level far above what is normal while on land. All parties will feel perfectly free to call attention to problems in this area without fear of giving offense -- it is a ship's regulation and their duty to comply.

   C. Orderliness and efficiency in use and stowing of scientific gear is a "must."

   D. Each person should organize his work ahead of time.

   E. All scientists should help one another (this frequently means volunteering; sometimes the greatest help may be to keep out of the way).

   F. Conserve freshwater and electricity (shut off lights).

   G. Keep toilets clean.

H. All hands have responsibility to work at periodic clean-up of ship.

I. All hands must help as needed with ship operations such as pulling anchor, standing wheel watch, etc.

7. It was agreed that, hereafter, each participating institution will pay for food costs during cruises in proportion to the number of persons that institution has on board (i.e., on a cruise with two U of A scientists, one U de B.C. scientist, and one UNAM scientist, U of A will contribute 50% of the food costs, the other two institutions will each contribute 25%).

C. Ancillary Uses of Oceanographic Buoys

It was established that, at least for the present, none of the participants has need to place any equipment on the buoys other than the NASA instrumentation for which they were designed.

Meeting 2 -- DATA ANALYSIS PLAN (1930 - 2130 hours)

Ms. Flanagan and McIntosh explained the data analysis plans, following the description in the handbook. Copies of the computer data for cruises 1 and 2 were then passed out, and participants were guided through the forms with explanations as necessary. There was a period of questions and answers regarding opportunities for the other participating institutions to take advantage of U of A computer analysis facilities.

Meeting 3 -- OTHER PROJECT ACTIVITES (2130 - 2330 hours)

A. Lt. Calderon assisted by Dr. Lepley gave a presentation of photoanalysis work now in progress on ERTS-1 imagery, showing examples of analysis techniques which stimulated considerable discussion about new opportunities for obtaining desired information by way of the imagery.

B. Mr. Mangum gave an overview of the electronics involved in the program, particularly with respect to the instrument buoys relaying information by way of the satellite.

C. With Mr. Stonesifer's assistance, there was discussion of the ERTS-2 program and mechanisms for the Mexican participants to submit no-cost proposals through appropriate channels in Mexico. There was also discussion of continued cooperation in carrying out a program based on a U of A proposal for ERTS-2.

D. Ocean. Nishikawa announced that U de B.C. now has copies of the newly-acquired Gulf of California tidal data produced by Scripps Institution. He will send copies of this to Dr. Thomson at the U of A.

E. U de B.C. handed in data from cruise 3 (25-27 October) for archiving and processing.

F. U de B.C. called attention to the fact that there was going to be a special concentrated oceanographic investigation in the Gulf of California during the period 11-29 March, 1973. This program would stress studies of current patterns and would have the "AGASSIZ" and the "HUMBOLDT" working in more southerly sections of the Gulf; hopefully, the "ADVENTYR" might work at the same time in the northern portion of the Gulf as in coordination with the other two ships. It was agreed that this

would be desirable and that every effort should be made to coordinate our work with the major, general program during the period designated. This will be explored further to see how far our work and the "ADVENTYR'S" time may be integrated into the larger program.

G. U de B.C. announced that they plan to hold the First International Symposium on the Seas of Baja California in Ensenada in October of 1973. The hope was expressed that other institutions participating in the present program might have significant input to the symposium. Hendrickson, speaking for the U of A, expressed enthusiasm over the idea and pledged at least two (probably more) papers.

H. It was tentatively agreed that the next meeting of this group will be on January 26-27 in Tucson. The meeting would begin on the morning of Friday the 26th and last through Saturday the 27th. Hopefully, representatives from Scripps Institution and from Instituto de Pesca, Mexico City can attend to assist in planning the cooperative cruise mentioned in "F" above.

I. The U of A promised to produce and circulate a record of this meeting, which consists of the foregoing.

Marine Resources and Ocean Surveys:

Bathymetry

A progress I report is submitted for the period August 1-November 30, 1972, for investigation UN 603, "Study of the Marine Environment of the Northern Gulf of California". Progress in the major phases of the project is described. The most important feature of the report is the identification of the first significant results to emerge from the investigation. These results are outlined below.

Preliminary analysis of the first three months of ERTS-1 imagery have revealed that the MSS images have particular utility for study of turbidity patterns, current phenomena, and bathymetry throughout the test area. Though final conclusions will depend upon correlation with the ground observations, early indications are that well defined spatial distributions of turbidity exist in the northern Gulf of California, and that for any one point in time, these distributions vary with depth. From a single set of images, as many as 3 turbidity maps may be generated, each indicating a vertical spatial relationship of the turbidity masses.

The spatial distribution of turbidity masses depend partially upon the coincident currents. Separating out the two components of current state in the test area may prove to be difficult since the general circulation current of the northern Gulf of California is masked by the much stronger tidal currents.

Significant differences in the distribution of the turbidity patterns with respect to time have appeared. It is hoped that the ground truth will reveal the reasons for such drastic changes; thus far there does not appear to be correlation with the distinct monthly tidal periodicity as first suspected. In one portion of the test area a stable turbid water mass has appeared constant in the first three months of imagery. This area does correspond with one of high biological productivity.

In the band of deepest penetration, a map can be gathered which roughly corresponds to the bathymetry of the area. In some cases a marked difference exists between published soundings and shelf discontinuities indicated by the imagery. Fathometer records from the ground observation cruises will be used in conjunction with this band to product updated versions of current bathymetric charts.

The extreme tides in the northern Gulf of California result in vast areas which can be classified as intertidal mud flats. The 18-day images often reveal differences in the amount of tidal exposure and also indicate basin evaporation areas. The areas of exposure associated with each tidal state can be defined by means of the ARTES densitometer and computed. Information on the amount of exposure at the varying tidal states is important in analysis of these mud flat areas as nursery grounds for Mexican commercial fisheries.

Marine Resources and Ocean Surveys:

Coastal Zone Processes

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Marine Resources and Ocean Surveys:

Estuary Dynamics

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Marine Resources and Ocean Surveys:

General

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Marine Resources and Ocean Surveys:

Locating Biologically Rich Areas

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Marine Resources and Ocean Surveys:

Surveys of Current and Ocean Dynamics

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